A Practical Method for Presenting Drug Interactions to Clinicians

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Computerized decision-support systems can aid in the prevention of a variety of adverse medical events. In one study, drug-drug interaction (DDI) checking had the potential to prevent up to 2.6% of all adverse events occurring on a medical service[1]. Our drug database (Medicom) contains nearly 26,000 DDI's of variable importance; even using only the interactions in its highest categories, it would generate far too many warnings for practical use by physicians in a clinical setting. Additionally, the overhead of checking so many potential interactions would unduly slow the ordering process. Rather than ask the ordering physicians to go through all of these warnings, health care institutions often decide to run these checks in the pharmacy, late in the ordering process. However, it is considerably more efficient to present DDI warnings at the time of medication ordering; the ordering physician can respond immediately, by changing to a different drug or modifying the dose. We have developed a method which makes presenting DDI's to physicians practical.

This DDI method is based on the use of functional drug-family tables. Each table contains selected chemical ingredients, specific medications, and/or other drug family tables, all of which act in a common fashion. For example, a table may contain all aminoglycosides, all antibiotics (by combining families like aminoglycosides and penicillins), or all drugs containing acetaminophen. For DDI checking, a table may include all drugs and families that interact with warfarin. These tables are "activated" if a patient is currently on a drug covered in the table. DDI checking for a new warfarin order then becomes a matter of determining whether its interacting-drugs table has already been activated, rather than checking each of the individual Medicom interactions. By building tables in this modular fashion, we are able to make use of them for a variety of interventions, and also to maintain them independently of the DDI application. If a new drug is added to the aminoglycoside family, all tables which use that family will be updated automatically.

To identify the most important set of drug-drug interactions, we used empirical data[2], literature review, and expert opinion provided by both physicians and pharmacists. This process reduced the DDI set to 94 tables in six severity categories. For example, out of 457 Medicom interactions between warfarin and other ingredients, we initially created 16 tables. After the clinical review process, we further condensed this to 4 tables, encompassing 27 of the original 457 interactions.

We ran the system on our inpatient service, without alerting, for a trial period of four weeks. During this time there were 3463 admissions and 67428 new medication orders. Of the orders, 402 (0.6%) generated 440 significant interactions. None were in the most serious ("do not order") category, although there were many (20%) in the next serious ("probably should not order") category. Of the interactions, 95% involved warfarin. After analyzing the findings, we refined the DDI tables once more to remove certain drugs, such as eyedrops, which contained insignificant amounts of an interacting ingredient.

We feel we have made DDI checking sufficiently fast and relevant to be able to present DDI warnings to physicians at the time of ordering. A key advantage to the table method is that updates to the formulary are automatically carried into the proper DDI table, eliminating the need to wait for periodic Medicom updates. The table concept can also be used for other drug checking, including allergies, drug-lab and drug-condition interactions. We plan to study how often change results from these warnings. We also plan to improve the system further by including pertinent lab results as part of the DDI checking logic and by providing more available action items at the time of the warning, such as suggested orders for lab tests and modifications to all involved drugs.

References

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